

WHAT IS CLAIMED IS:

1 1. A device for delivering a substance to a bone, the device
2 comprising:

3 (a) a bone screw comprising two ends connected by a shaft,
4 wherein the shaft is cannulated along at least a portion of its length;

5 (b) one or more bone-screw fenestrations disposed along the
6 cannulated portion of the bone-screw shaft;

7 (c) an insert disposed inside the cannulated bone-screw shaft,
8 wherein the insert is cannulated along at least a portion of its length; and

9 (d) one or more insert fenestrations disposed along the cannulated
10 portion of the insert to provide a delivery pathway for the substance between at least
11 one end of the bone screw and the at least one bone-screw fenestration.

1 2. The device of claim 1 wherein the insert partially blocks at
2 least one bone-screw fenestration.

1 3. The device of claim 1 wherein the insert completely blocks at
2 least one bone-screw fenestration.

1 4. The device of claim 1 wherein the cannulated portion of the
2 bone-screw shaft extends through the entire length of the bone screw.

1 5. The device of claim 1 wherein the bone screw is a fixation
2 screw.

1 6. The device of claim 1 wherein one end of the bone screw is
2 self-tapping.

1 7. The device of claim 1 wherein the bone screw comprises a
2 material selected from the group consisting of titanium and its alloys, tantalum and its

3 alloys, nickel-cadmium and its alloys, steel and its alloys, plastics, absorbable
4 materials, resorbable materials, polyamino acids, polylactide, polyglycolide,
5 hydroxylapatite, and tricalciumphosphate.

1 8. The device of claim 1 wherein the insert comprises a material
2 selected from the group consisting of titanium and its alloys, tantalum and its alloys,
3 nickel-cadmium and its alloys, steel and its alloys, plastics, absorbable materials,
4 resorbable materials, polyamino acids, polylactide, polyglycolide, hydroxylapatite,
5 and tricalciumphosphate.

1 9. The device of claim 1 further comprising a substance reservoir
2 attached to at least one end of the bone screw.

1 10. The device of claim 9 wherein the reservoir is implanted
2 subcutaneously.

1 11. The device of claim 1 further comprising a pump attached to at
2 least one end of the bone screw.

1 12. The device of claim 11 wherein the pump is implanted
2 subcutaneously.

1 13. A device for delivering a substance to a bone, the device
2 comprising:

3 (a) a bone screw comprising two ends connected by a shaft,
4 wherein the shaft is cannulated along at least a portion of its length;

5 (b) one or more bone-screw fenestrations disposed along the
6 cannulated portion of the bone-screw shaft; and

7 (c) an insert disposed inside the cannulated bone-screw shaft,
8 wherein the insert is cannulated along at least a portion of its length, and further
9 wherein the insert is permeable to the substance to be delivered to the bone.

1 14. The device of claim 13 wherein the insert further comprises at
2 least one insert fenestration disposed along the cannulated portion of the insert.

1 15. The device of claim 13 wherein the cannulated portion of the
2 bone-screw shaft extends through the entire length of the bone screw.

1 16. The device of claim 13 wherein the bone screw is a fixation
2 screw.

1 17. The device of claim 13 wherein one end of the bone screw is
2 self-tapping.

1 18. A method of administering a substance to a bone, the method
2 comprising:

3 (a) introducing a bone screw into a bone, the bone screw
4 comprising two ends connected by a shaft, wherein the shaft is cannulated along at
5 least a portion of its length, and further wherein the bone screw comprises one or
6 more bone-screw fenestrations disposed along the cannulated portion of the bone-
7 screw shaft;

8 (b) introducing an insert into the bone screw, wherein the insert is
9 cannulated along at least a portion of its length, and further wherein the insert
10 comprises one or more insert fenestrations along the cannulated portion of the insert;
11 and

12 (c) introducing a substance into the cannulated portion of the
13 insert.

1 19. The method of claim 18 wherein at least part of the insert is
2 introduced into the bone screw prior to introducing the bone screw into the bone.

1 20. The method of claim 18 wherein at least part of the insert is
2 introduced into the bone screw after introducing the bone screw into the bone.

1 21. The method of claim 18 wherein two or more bones are held in
2 a fixed position relative to each other by the bone screw.

1 22. The method of claim 18 wherein a peripheral skeletal fracture
2 is mended, an osteotomy is mended, a spondyloysis is repaired, an odontoid fracture
3 repaired, or lumbar facet joints are fused by the insertion of the bone screw into the
4 bone.

1 23. The method of claim 18 further comprising attaching a
2 reservoir to at least one end of the bone screw or insert.

1 24. The method of claim 18 further comprising attaching a pump to
2 at least one end of the bone screw or insert.

1 25. The method of claim 23 wherein the reservoir is implanted
2 subcutaneously.

1 26. The method of claim 24 wherein the pump is implanted
2 subcutaneously.

1 27. A method of administering a substance to a bone, the method
2 comprising:

3 (a) introducing a bone screw into a bone, the bone screw
4 comprising two ends connected by a shaft, wherein the shaft is cannulated along at
5 least a portion of its length, and further wherein the bone screw comprises one or
6 more bone-screw fenestrations disposed along the cannulated portion of the bone-
7 screw shaft;

8 (b) introducing an insert into the bone screw, wherein the insert is
9 cannulated along at least a portion of its length, and further wherein the insert is
10 permeable to the substance to be administered; and

11 (c) introducing a substance into the cannulated portion of the
12 insert.

1 28. A method of manufacturing a substance delivery device
2 comprising :

3 (a) producing a bone screw comprising two ends connected by a
4 shaft, wherein the shaft is cannulated along at least a portion of its length, and further
5 wherein the bone screw comprises one or more bone-screw fenestrations disposed
6 along the cannulated portion of the bone-screw shaft; and

7 (b) producing an insert that fits in the bone screw, wherein the
8 insert is cannulated along at least a portion of its length, and further wherein the insert
9 comprises one or more insert fenestrations along the cannulated portion of the insert.

1 29. A method of manufacturing a substance delivery device
2 comprising :

3 (a) producing a bone screw comprising two ends connected by a
4 shaft, wherein the shaft is cannulated along at least a portion of its length, and further
5 wherein the bone screw comprises one or more bone-screw fenestrations disposed
6 along the cannulated portion of the bone-screw shaft; and

7 (b) producing an insert that fits in the bone screw, wherein the
8 insert is cannulated along at least a portion of its length, and further wherein the insert
9 is permeable to the substance to be delivered.